



## PV Limits based on Increasing Speed and Increasing Pressure

		Commercially	Ī		Con	nposi	tions	<u>:</u>	·	PV Limit	PV Limit
Ì		Available	Polymeric Matrix							Based on	Based on
	Polymeric	Competetive	Materials used		ŀ	ł				Increasing	Increasing
Test	Matrix	Materials	for exemplary	%	First	1 %	Second	1 %	Method Of	Velocity	Pressure
#		(PreBlended)	Compositions		Additive		Additive(s)		Blending	@ 100 psi	@ 25 FPM
1	PEI		Ultem 1010	55	DKD Fiber	30	TFE Fiber	15	Solvent	90,000	50000 +
2	PEI		Ultern 1010	55	DKD Fiber	30	TFE Fiber	15	Solvent	97,000+	65000+
3	PEI		Uitem 1010	55	DKD Fiber	30	TFE Fiber	15	Solvent	90,000+	
4	PEI		Uitem 1010	55	DKD Fiber	30	TFE Fiber	15	Dry	60,000	
5	PEI		Ultem 1010	55	DKD Fiber	30	TFE Powder	15	Solvent	60,000	
<u>6</u>	PEI		Ultern 1010	50	DKD Fiber	25	BN Platelets	25	Solvent	90,000+	
7	PEI		Ultern 1010	70	TFE Fiber	30			Solvent	40,000	
¥ġ.	PEI		Ultern 1010	70	DKA Fiber	30			Solvent	30,000	
<del>-</del> 0	PEI		Ultem 1010	60	DKA Fiber	40			Solvent	50,000	
<b>≟</b> 10	PEI		Ultern 1010	50	DKA Fiber	50			Solvent	60,000	
Lin.	PEI		Ultem 1010	40	DKA Fiber	60			Solvent	70,000	
12	PEI		Ultern 1010	30	DKD Fiber	60	BN Platelets	10	Solvent	90,000+	
13	PEI	1	Ultem 1010	100					PreBlend	< 10,000	
114	PEI	Ultem 7201		80	Carbon Fiber	20			PreBlend	40,000	
<sub>=</sub> , 15	PEI	Ultem 7301		75	Carbon Fiber	25			PreBlend	20,000	
.≕16	PEI	EL 4040		80			TFE Powder	20	PreBlend	20,000	
17	PEEK		Victrex 150	55	DKD Fiber	30	BN Platelets	15	Dry	60,000	
18	PEEK		Victrex 150	55	DKD Fiber	30	BN Platelets	15	Dry	50,000	
19	PEEK		Victrex 150	55	DKD Fiber	25	BN Platelets	25	Dry	80,000	
20	PEEK	Victrex FC 30		70	Carbon Fiber	10	Graphite Powder/TFE Powder	10/10	PreBlend	30,000	30,000
-21	PEEK	Victrex FC 30		70	Carbon Fiber	10	Graphite Powder/TFE Powder	10/10	PreBlend	40,000	30,000
-22	PEEK	Victrex CA 30		70	Carbon Fiber	30			PreBlend	30,000	30,000
23	PEEK	Victrex CA 30		· 70	Carbon Fiber	30			PreBlend	50,000	40,000
24	Pl	•	Aurem	55	DKD Fiber	30	TFE Fiber	15	Dry	70,000	
25	PVPEI		Aurem/Ultem 1010	44/11	DKD Fiber	30	TFE Fiber	15	Concentrate	90,000	
26	PL/PEI -		Aurem/Ultem 1010	37.5/12.5	DKD Fiber	25	BN Platelets	25	Concentrate	90,000	
27	. Ы	Aurem JNF 3020		80			TFE Powder	20	PreBlend	50,000	50,000
28	PI	Aurem JNF 3025					TFE Powder		PreBlend	40,000	30,000
29	PI	Aurem JCN 6530		70	Carbon Fiber	30			Preßlend	40,000	45,000
30	PI	Aurem JCF 6525			Carbon Fiber				PreBlend	40,000	30,000
31	LCP/PEI		LCP/Ultern 1010	37.5/12.5	DKD Fiber	25	BN Platelets	25	Concentrate	90,000	
32	LCP	Vectra B230		70	Carbon Fiber	30			PreBlend	10,000	15,000
33	PPS		Ticona 020584	. 55	DKD Fiber	30	TFE Fiber	15	Dry	50,000	56,000
34	PPS		Ticona 020584	50	DKD Fiber	25	BN Platelets	25	Dry	50,000	
35	PPS	OL 4060		70			. TFE Powder	30	PreBlend	30,000	30,000
36	PAI	Torlon 7130		70	Carbon Fiber	30			PreBlend	30,000	35,000
37	PAI	Torion 4301		85			Graphite Powder/TFE Powder	12/3	PreBlend	30,000	20,000
٠١						1				لــــــــــــــــــــــــــــــــــــــ	

Table 2

T [] T Behing Wear Properties = [] En []

		Commercially			3	itioodu												
		Aunilable	Only of the Control o		3	Onicodiiioo									ĺ			
		Available	Polymeric Matrix															
	Polymeric	Competetive	Materials used								Wear (K)		Shaft	Shaft Temperature (F)	re (F)	Coeffi	Coefficient of Friction	tion
Test	Matrix	Materials	for exemplary	%	First	%	Second	%	Method	Pre	Pressure x Velocity	clty	Pres	Pressure x Velocity	clty	Pres	Pressure x Velocity	city
#		(PreBiended)	Compositions		Additive		Additive(s)		Of Blending	50x200	100×100	200×50	50x200	100×100	200x50	50×200	100×100	200×50
38	ЬEI		Ultern 1010	55	DKO Fiber	30	TFE Fiber	15	Solvent	8	12	16	140	170	180	0.2	0.22	0.21
33	PEI		Ultem 1010	55	DKO Fiber	30	TFE Fiber	15	Extrusion	25	21	23	180	255	220	0.32	0.28	0.28
40	DG		Ultern 1010	55	DKD Fiber	30	TFE Powder	15	Solvent	13	5	25	200	250	195	0.4	0.36	0.3
41	핊		Ultern 1010	90	DKD Fiber	25	BN Platelets	25	Solvent	15	23	12	170	170	160	0.24	0.19	0.19
42	PEI		Ultem 1040	30	DKD Fiber	99	BN Platelets	5	Solvent	18	5	12	132	170	174	0.24	0.19	
43	PEI	Ultern 7201		80	Carbon Fiber	20			PreBlend	173	20	79	365	265	335	0.52	0.24	
\$		EL 4040		80			TFE Powder	20		101	52	99	250	250	250	0.36	0.12	2:0
45	PEEX		Victrex 150	99	DKD Fiber	30	TFE Fiber	15	Dry	22	56	19	320	245	250	0.3	0.3	0.3
46	Ä		Victrex 150	55	DKD Fiber	30	BN Platelets	15	Dry	6	6	9	150	175	160	0.32	0.24	0.19
47	Ä		Victrex 150	50	DKD Fiber	25	BN Platelets	25	Dry	9	9	2	155	175	160	0.32	0.24	0.2
84	PĒĶ		Victrex 150	90	DKD Fiber	25	BN Platelets	25	Extrusion	19	19	10	135	175	150	0.24	0.22	0.2
6	Ä		Victrex 150	30	DKD Fiber	2			Dry	24		36	142		142	0.3		0.24
S	Ä		Victrex 150/Ultern 1010	41/9	DKO Fiber	25	BN Platelets	25	Concentrate	19	19	10	135	180	165	0.24	0.22	0.22
51	Ä	Victrex FC30		70	Carbon Fiber	5	Graphite Powder/TFE Powder	10/10	PreBlend	177	160	251	306	290	260	0.33	0.4	0.2
22	Ä	Victrex CA30		70	Carbon Fiber	æ			PreBlend	200	77	120	350	310	375	0.62	0.56	0.7
22	PEEK	LL 4030		85			TFE Powder	15	PreBlend	172	22	30	204	238	208	0.34	0.21	0.2
2	PI/PEI		Aurem/Ultern 1010	44/11	DKD Fiber	33	TFE Fiber	15	Concentrate	20	35	20	210	205	220	0.28	0.28	0.32
55	PI/PEI		Aurem/Ultem 1010	37.5/12.5	DKD Fiber	22	BN Platelets	25	Concentrate	4	10	6	190	212	190	0.3	0.2	0.18
26		Aurem JCF 6525							PreBlend	269	240	185	374	115	337	0.45	0.44	0.38
57	ā.	Aurem JCN 6530		70	Carbon Fiber	೫			PreBlend	115	109	161	375	390	340	0.57	0.62	0.48
88	ā.	Aurem JNF 3020		80			TFE Powder	20	PreBlend	113	108	143	250	334	150	0.38	0.29	0.19
29	LCP/PEI		LCP/Ultern 1010	37.5/12.5	DKD Fiber	25	BN Platelets	52	Concentrate	3	21	1	185	176	170	0.24	0.2	0.16
8	క్రి	Xydar 96043		40	Carbon Fiber	8			PreBlend	241	223	210	187	180	100	0.4	0.38	2
ة	È	Vectra B230		70	Carbon Fiber	೫			PreBlend	160	125	50	351	290	569	0.40	0.44	
62	PPS		Ticona 020584	55	DKD Fiber	e	TFE Fiber	15	Dry			16	-		251			E
8	PPS		Ticona 020584	20	DKD Fiber	22	BN Platelets	25	Dry	26	18	10	210	226	234	0.29	0.27	0.28
8	PPS	OL 4040		80			TFE Powder	20	PreBlend	256	48	110	298	201	251	0.43	0.16	0.25
65	PPS	1300AR15TFE15		70	Aramid Fiber	15	TFE Powder	15	PreBlend	124	192	509	250	302	272	0.25	0.17	0.27
	Footnote 1: T	he PV Limit based o	Footnote 1: The PV Limit based on increasing speed at 200 psi is:	si is:														
	•	PV Limit	Shaft Temperature	Coefficient of Friction	of Friction													
		180,000	315	0.02														
		180,000	310	0.03								-						

# Wear Properties at High Values of Pressure X Velocity

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  | 0.08  |   | Melted  | Meltec   
  | 90'0  | 9.0   | 0.04  |  |   | Melted (  
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   | Melted (1)   | Melted   | 0.04  
   
   
   
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  |   | 90.0  | 1.0   |  |   | 0.1   
   | Melted  |  | Melted (5)  | 0.04  |  
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| cient of Fr      | sure x Velo    | 40,000  | 200 X 200  
   
   
   | 0.12   | 0.14   | 0.1   
   
   
   
   | 0.12  
   
   
  | 0.2   |   | 0.1   | 90.0   
  |   | 90.0  | 90.0  |  |   | 0.12  
   | 0.28  |  | 0.14  | 0.12  | Melted (3)   
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| Coeffi           | Pres           | 20,000  | 00 X 100   
   
   
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  | 0.2   |   | 0.16  | Melted   | Metted  | 0.3   
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  | 0.24  |   | 0.3   | 0.2  
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  | 230   | 175   | 200   |  |   | Aelted (4)  
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  | 280   |   | 460   | 270  
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   | Melted  |  | elted (5)   | 217   |  
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| nperature        | e x Veloci     | H   | 0 X 200 Z  
   
   
   | 330 M  | 340 M  | 241   
   
   
   
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   | 15   | 5  | 25  
   
   
   
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|                  |                | Second  | Additive(s)  
   
   
   | TFE Fiber  | TFE Fiber  | BN Platelets  
   
   
   
   | BN Platelets  
   
   
  | DC4-7105  |   | TFE Fiber   | BN Platelets   
  | BN Platelets  | CAPOW L38/H   | BN Platelets/DC4-7105   | Graphite Powder/TFE Powder   |   | DC4-7105  
   | Graphite Powder   | TFE Powder   | TFE Fiber   | BN Platelets  |  
  | TFE Powder   |
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|                  |                | First   | Additive   
   
   
   | DKD Fiber  | DKD Fiber  | DKD Fiber   
   
   
   
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  | DKD Fiber   | DKD Fiber   | DKD Fiber   | Carbon Fiber   | Carbon Fiber  | DKD Fiber   
   | DKD Fiber   |  | DKD Fiber   | DKD Fiber   | Carbon Fiber   
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  | 28  | 80 C  | 55  | 20   
  | 90  | 59  | 48  | 70   | 02  | 28  
   | 30  | 80   | 44/6  | 38/12   | 70 (   
  | 88   |
| Polymeric Matrix | Materials used | for exemplary   | Compositions   
   
   
   | Ultern 1010  | Ultern 1010  | Ultern 1010   
   
   
   
   | Ultern 1010   
   
   
  | Ultem 1040  |   | Victrex 150   | Victrex 150  
  | Victrex 150   | Victrex 150   | Victrex 150   |  |   | Ticona 020584   
   | Ticona 020584   |  | Aurem/Ultem 1010  | Aurem/Ultern 1010   |  
  |  |
|                  |                | Materials   | (PreBlended)   
   
   
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  |   | Ultem 7201  |   |  
  |   |   |   | Victrex FC30   | Victrex CA30  |   
   |   | 0L 4040  |   |   | Aurem JCN 6530   
  | Aurem JNF 3020   |
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|                  | Available      | Available         Polymeric Matrix         Shaft Temperature (F)           Competetive         Materials used         Pressure x Velocity | Available         Polyment Matrix         Shaft Temperature (F)         Coefficient of Fric           Competetive         Materials used         First         % Method         10,000         40,000         100,000         10,000         100,000 <td>Available         Polyment Matrix         Polyment Matrix         Shaft Temperature (F)         Shaft Temperature (F)         Coefficient of Friction           Competetive         Materials used         First         %         Method         10,000         20,000         40,000         100,000         100,000         20,000         40,000         20,000         40,000         20,000         40,000         20,000         40,000         20,000         40,000         20,000&lt;</td> <td>Polymetrod Matrix         Materials used         Pressure x Velocity           Materials used         %         First         %         Second         %         Method         10,000         20,000         40,000         80,000         100,00</td> <td>Available         PolymertC Materials used         First         %         Record         %         Method         10,000         20,000         40,000         80,000         100,000         <th< td=""><td>Available         PolymertC Materials used         First         %         Recompetetive         Method         10,000         20,000         40,000         80,000         10,000<td>Available Competetive Materials used Materi</td><td>Available Competitive Materials used Materi</td><td>Available Dolymert Matrix         Materials used Materials used</td><td>Available Dolyment Matrix         Materials used Materials used</td><td>Available formation of Programment Analysis used Competetive Materials (a. 2.2.0.00 Materials used Competetive Materials used Competetive Materials used Competetive Materials (b) 2.0.0 Materials used Competetive Materials (competetive Materials used Competetive Materials (competetive Materia</td><td>Available Competitive Materials used         Available Materials used         First National Materials used         First National Materials used         Available Materials used         Shart Tomperature (F)         Shart Tomperature (F)         Shart Tomperature (F)         Pressure x Velocity         Pressure</td><td>Available Competetive Matrix by Competed Matrix Brief Matrix</td><td>Available Commendative Materials used Materials used Polymert Materials used Commendative Materials used Materials used Polymert Materials (Compositive)         First No. 200</td><td>Available         Polymente Materials used         Available         Polymente Materials used         Available         Pressure X velocity         Second 100 mode of 10</td><td>Available Volyment Matrials Second Waterials of Polyment Matrials Second Waterials Se</td><td>Available Competition of Executed Internal Exercision Matching Internal Exercision Inte</td><td>Available Polymeric Matrix Formation of Composition of Materials used Formation of Composition of Compositions (Freezing Materials)         First Name (Freezing Name (Fr</td><td>Available Materials (Authority Matrice)         Figure (Matrice)         Figure (Matrice)         Figure (Matrice)         Secretal (Matrice)         Available (Matrice)         Presentation (Matrice)         Secretal (Matrice)         Available (Matrice)         Figure (Matrice)         Secretal (Matrice)         Available (Matric</td><td>  Available   Polymetic Matrix   Competitions and Matrix   Matrix</td><td>  Application   Polymente battom   Application   Polymente battom   Application   App</td><td>Completely Material Independent Annual Completely Material Independent Annual Independent Annual Independent Annual Independent Annual Independent Annual Indexesses and a second with a second Annual Indexesses and a second Annual Indexesses Indexes Index</td></td></th<></td> | Available         Polyment Matrix         Polyment Matrix         Shaft Temperature (F)         Shaft Temperature (F)         Coefficient of Friction           Competetive         Materials used         First         %         Method         10,000         20,000         40,000         100,000         100,000         20,000         40,000         20,000         40,000         20,000         40,000         20,000         40,000         20,000         40,000         20,000< | Polymetrod Matrix         Materials used         Pressure x Velocity           Materials used         %         First         %         Second         %         Method         10,000         20,000         40,000         80,000         100,00 | Available         PolymertC Materials used         First         %         Record         %         Method         10,000         20,000         40,000         80,000         100,000 <th< td=""><td>Available         PolymertC Materials used         First         %         Recompetetive         Method         10,000         20,000         40,000         80,000         10,000<td>Available Competetive Materials used Materi</td><td>Available Competitive Materials used Materi</td><td>Available Dolymert Matrix         Materials used Materials used</td><td>Available Dolyment Matrix         Materials used Materials used</td><td>Available formation of Programment Analysis used Competetive Materials (a. 2.2.0.00 Materials used Competetive Materials used Competetive Materials used Competetive Materials (b) 2.0.0 Materials used Competetive Materials (competetive Materials used Competetive Materials (competetive Materia</td><td>Available Competitive Materials used         Available Materials used         First National Materials used         First National Materials used         Available Materials used         Shart Tomperature (F)         Shart Tomperature (F)         Shart Tomperature (F)         Pressure x Velocity         Pressure</td><td>Available Competetive Matrix by Competed Matrix Brief Matrix</td><td>Available Commendative Materials used Materials used Polymert Materials used Commendative Materials used Materials used Polymert Materials (Compositive)         First No. 200</td><td>Available         Polymente Materials used         Available         Polymente Materials used         Available         Pressure X velocity         Second 100 mode of 10</td><td>Available Volyment Matrials Second Waterials of Polyment Matrials Second Waterials Se</td><td>Available Competition of Executed Internal Exercision Matching Internal Exercision Inte</td><td>Available Polymeric Matrix Formation of Composition of Materials used Formation of Composition of Compositions (Freezing Materials)         First Name (Freezing Name (Fr</td><td>Available Materials (Authority Matrice)         Figure (Matrice)         Figure (Matrice)         Figure (Matrice)         Secretal (Matrice)         Available (Matrice)         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Tomperature (F)         Pressure x Velocity         Pressure | Available Competetive Matrix by Competed Matrix Brief Matrix | Available Commendative Materials used Materials used Polymert Materials used Commendative Materials used Materials used Polymert Materials (Compositive)         First No. 200 | Available         Polymente Materials used         Available         Polymente Materials used         Available         Pressure X velocity         Second 100 mode of 10 | Available Volyment Matrials Second Waterials of Polyment Matrials Second Waterials Se | Available Competition of Executed Internal Exercision Matching Internal Exercision Inte | Available Polymeric Matrix Formation of Composition of Materials used Formation of Composition of Compositions (Freezing Materials)         First Name (Freezing Name (Fr | Available Materials (Authority Matrice)         Figure (Matrice)         Figure (Matrice)         Figure (Matrice)         Secretal (Matrice)         Available (Matrice)         Presentation (Matrice)         Secretal (Matrice)         Available (Matrice)         Figure (Matrice)         Secretal (Matrice)         Available (Matric | Available   Polymetic Matrix   Competitions and Matrix   Matrix | Application   Polymente battom   Application   Polymente battom   Application   App | Completely Material Independent Annual Completely Material Independent Annual Independent Annual Independent Annual Independent Annual Independent Annual Indexesses and a second with a second Annual Indexesses and a second Annual Indexesses Indexes Index |

Footnotes:

1. After 1 Hour
2. After 3 Hours
3. After 5 Minutes
4. After 15 Minutes
5. After 1 Minute

Table 4

Bearing Wear Properties at High-Eoads and Fow-Speeds

				_	_	<del>, .</del>	,			_		_	,					_
	Coefficient	ģ	Friction	0.2	0.32	0.3	0.13	Melted	90'0	60.0	0.1	0.1	0.16	Melted	Melted	0.17	0.36	Melfed
	Shaft	Temperature	Œ	280	160	170	143	Melted	230	180	210	250	180	Melted	Melted	250	250	Melted
		Wear (K)		15	38	28	6	Melted	33	20	19	20	11	Melted	Meited	33	124	Melled
		Method Of	Blending	Solvent	Solvent	Solvent	Solvent	PreBlend	Dry	Dry	Dry	Dry	Dry	PreBlend	PreBlend	Concentrate	Concentrate	PreBlend
		%		15	25	9	2		15	22	-	25/2	25/2	10/10		2	89	۶
		Second	Additive(s)	TFE Fiber	BN Platelets	BN Platelets	DC4-7105		TFE Fiber	BN Platelets	CAPOW L38/H	BN Platelets/DC4-7105	BN Platelets/DC4-7105	Graphite Powder/TFE Powder		DC4-7105	Graphite Powder	TFE Powder
		%		30	25	09	20	20	30	22	.02	25	52	10	99	70	10	
		First	Additive	DKD Fiber	DKD Fiber	DKD Fiber	DKD Fiber	Carbon Fiber	DKD Fiber	DKD Fiber	DKD Fiber	DKD Fiber	DKD Fiber	Carbon Fiber	Carbon Fiber	DKD Fiber	DKD Fiber	
		%		55	20	30	28	80	22	20	29	48	48	20	70	28	30	80
Polymeric Matrix	Materials used	for exemplary	Compositions	Ultern 1010	Ultern 1010	Ultem 1010	Ultern 1040		Victrex 150	Victrex 150	Victrex 150	Victrex 150	Victrex 150			Ticona 020584	Ticona 020584	•
Available	Competetive	Materials	(PreBlended)					Ultern 7201						Victrex FC30	Victrex CA30			OL 4040
	Polymeric	Matrix		PE	PEI	PEI	PEI	PEI	PEEK	PEEK	PEEK	PEEK	PEEK	PEEK	PEEK	PPS	PPS	PPS
		Test	#	98	87	88	89	90	91	92	93	94	R	96	97	86	66	5
	Available Polymeric Matrix	Available Polymeric Matrix Competetive Materials used Shaft	Available Polymeric Materials used Second % Method Of Wear (K) Temperature	Available Polymeric Materials used Polymeric Materials used Second Wear (K) Temperature (PreBlended) Compositions Additive Additive (F)	Polymeric PolymericAvailable Materials used (PreBlended)Polymeric Materials Materials CompositionsFirst Additive%Second Additive%Method Of AdditiveWear (K)Temperature (F)PEIUltern 101055DKD Fiber30TFE Fiber15Solvent15280	Polymeric         Available Materials used         Materials used         First         %         Second         %         Method Of Plentine         Wear (K)         Temperature           PEI         Ultern 1010         55         DKD Fiber         35         BND Fiber         35         BN Platelets         25         Solvent         38         160	Available Polymeric Materials used         Materials used         First         %         First         %         Second         %         Method Of Method Of Mear (K)         Wear (K)         Temperature Temperature           Matrix Materials         Materials used         First         %         First         %         Method Of Mear (K)         Temperature         (F)           PEI         Compositions         Additive         30         TFE Fiber         15         Solvent         15         280           PEI         Ultern 1010         50         DKD Fiber         25         BN Platelets         25         Solvent         38         160           PEI         Ultern 1010         30         DKD Fiber         60         BN Platelets         10         Solvent         28         170	Polymeric         Available         Polymeric Materials used         First         %         First         %         Method Of Met	Polymeric         Available Materials used         Materials used         First         %         Second Nethod Of Sherting         %         Method Of Mear (K)         Temperature Temperature           PEI         (PreBlended)         Compositions         55         DKD Fiber         30         TFE Fiber         15         Solvent         15         280           PEI         Ultern 1010         55         DKD Fiber         55         BND Fiber         55         BN Platelets         25         Solvent         38         160           PEI         Ultern 1010         30         DKD Fiber         60         BN Platelets         25         Solvent         28         170           PEI         Ultern 1040         28         DKD Fiber         70         DC4-7105         2         Solvent         9         143           PEI         Ultern 7201         28         DKD Fiber         70         DC4-7105         2         Solvent         9         143	Polymeric         Competetive Materials used         First         %         Second Naterials         %         Method Of Near (K)         Wear (K)         Temperature (F)           Materials         for exemplary (PreBlended)         Compositions         Additive         30         TFE Fiber         15         Solvent         15         280           PEI         Ultern 1010         50         DKD Fiber         25         BN Platelets         10         Solvent         28         170           PEI         Ultern 1010         30         DKD Fiber         60         BN Platelets         10         Solvent         28         170           PEI         Ultern 1040         28         DKD Fiber         70         DC4-7105         2         Solvent         28         143           PEI         Ultern 1040         28         DKD Fiber         70         DC4-7105         2         Solvent         9         143           PEI         Ultern 1040         28         DKD Fiber         20         BC4-7105         2         Solvent         9         143           PEI         Ultern 7201         80         Carbon Fiber         30         TFE Fiber         15         Dry         30         143	Polymetic         Available         Polymetic Materials used         First         %         Second         %         Method Of Okto Fiber Okto	Polymetic Materials used         Available (Dribber of Dompetitive)         Materials used (PreBlended)         First         %         First Pick         %         First Pick         %         Second Pick Pick         %         Method Of Pick Pick Pick Pick Pick Pick Pick Pick	Polymetic         Competetive Materials used         First         %         Second Pactitive(s)         %         Method Of Method Of Mean (K)         Wear (K)         Temperature (F)           Materials (Ompositions PEI)         Compositions (Ompositions)         Additive         30         TFE Fiber         15         Solvent         15         Solvent (K)         Temperature (F)           PEI         Ultern 1010         55         DKD Fiber         25         BN Platelets         25         Solvent (K)         160         170           PEI         Ultern 1010         50         DKD Fiber         60         BN Platelets         10         Solvent (K)         38         170           PEI         Ultern 1010         30         DKD Fiber         70         DC4-7105         2         Solvent (K)         38         170           PEI         Ultern 1010         30         DKD Fiber         70         DC4-7105         2         Solvent (K)         38         143           PEEK         Ultern 7201         80         Carbon Fiber         70         CAPOW L38/H         15         Dry         20         180           PEEK         Nictex 150         50         DKD Fiber         70         CAPOW L38/H         1	Polymetric Matrix         Available Materials used         First         %         Second Second Second Second Method Of Polymetric Materials used Materials used Materials         First         %         First Second Second Second Method Of Polymetric Second Materials         %         Method Of Mear (K) Mear (K) Temperature Second Method Of Mear (K) Temperature Second Se	Polymeric Matrials used         First         %         First         %         Recond         %         Method Of Mear (K)         Wear (K)         Temperature           Matrix         Materials used         First         %         Second         %         Method Of Mear (K)         Temperature           PEI         Compositions         Additive         30         TFE Fiber         15         Solvent         15         280           PEI         Ultern 1010         50         DKD Fiber         25         BN Platelets         25         Solvent         38         170           PEI         Ultern 1010         30         DKD Fiber         25         BN Platelets         2         Solvent         38         170           PEI         Ultern 1010         30         DKD Fiber         20         BN Platelets         2         Solvent         38         143           PEI         Ultern 1040         28         DKD Fiber         20         BN Platelets         2         Solvent         39         143           PEEK         Victor 150         30         DKD Fiber         25         BN Platelets         25         Dby         20         180           PEEK         Victor 150	Polymeric Competetive Materials used Materials (Preblended) Compositions Additive S Materials DITEM Materials (Preblended) Compositions Additive S Materials S Materia	Polymetic Competetive Infantials used         First         %         First         %         Escond Second S	Polymeric         Available         Polymeric Materials used         Flirst         %         Second Second         %         Method Of Dear (K)         Shaft           Materials used         Compositions         Additive         30         Flirst         %         Additive(s)         Blending         %         Temperature           PEI         Ultem 1010         55         DKD Fiber         25         Solvent         15         Solvent         15         280           PEI         Ultem 1010         55         DKD Fiber         50         DKD Fiber         20         DKD47105         2         Solvent         38         170           PEI         Ultem 7201         Ultem 1010         30         DKD Fiber         50         DKD47105         2         Solvent         38         143           PEI         Ultem 7201         Ultem 1010         30         DKD Fiber         20         DK47105         2         Solvent         39         143           PEEK         Ultem 7201         Ultem 1040         30         DKD Fiber         20         DK47105         25         Solvent         30         130           PEEK         Ultem 7201         Wortex 150         30         DKD Fiber         <

# TABLE 5

Additive	Thermal Conductivity (W/m°C)
Aluminum Flake	204
Boron Nitride Powder	33-200
Bronze Powder	26
Graphite Powder	
Steel Fiber	52 ·
Stainless Steel Fiber	12-22

DEBEND ENTREED

Polymeric Matrix			Comp	osition			Wear (K)	Shaft Tem	Co- effic- eint	Test Duration (Hrs.)
Material	First Additive	Second Additive	% By Volume	% By Weight	Type of Carbon Fiber	Method of Blending		( <sup>p</sup> F)	of Fric t-ion	(22.5)
PEI Ultem1040	DKD		70/30	57.5/42.5	Pitch	SOLVENT	26	175	0.34	24
PEI Ultem1040	DKD	·	60/40	46/54	Pitch	SOLVENT	37	163	0.22	24
PEI Ultem1040	AGM 94		70/30	62/38	PAN	SOLVENT	206	360	0.44	24
PEI Ultem1010	AGM 94		60/40	51/49	PAN	SOLVENT	366	205	0.4	26
PEI Ultem1010	AGM 94		50/50	41/59	PAN	SOLVENT	210	280	0.4	24
PEI Ultem1040	AGM 95		50/50	40/60	РІТСН	SOLVENT	180	290	0.34	24
PEI Ultem 1040	AGM 94		43/57	35/65	PAN	SOLVENT	530	200	0.44	24
PEI Ultem 1010	AGM 94	BN Platelets	60/20/20	49/23/28	PAN	SOLVENT	10,000+	260	0.46	0.16
PEI Ultem 1040	VMX-24	BN Platelets	60/20/20	48/24/28	РІТСН	SOLVENT	10,000+	229	0.5	1
PEI Ultem 1040	VMX-24		60/40	50/50	PITCH	SOLVENT	112	370+	0.7	21
PEEK	DIALEAD K223 HG	BN Platelets	60/40	48/52	PITCH	DRY	12	140	0.14	24
PPS	DKD	,	60/40	48/52	Pitch	DRY	24	225	0.3	24
PPS	DIALEAD K223 HG	BN Platelets	64/18/18	50/25/25	PITCH	DRY	6	125	0.22	24
PPS	FORTAFI L				PAN	DRY	599	253	- 0.36	24
PPS	DIALEAD K223 HG LF	BN Platelets			PITCH	DRY	6 .	180	0.36	24
PC	DKD	BN Platelets	60/20/20	47/27/27	Pitch	SOLVENT	70	141	0.16	24
PC	GM 130	BN Platelets	60/20/20	48/23/29	PAN	SOLVENT	9875	300	0.36	2
PEI Ultem 1040	DKD		87.5/12.5	80/20	Pitch	SOLVENT	57	195	0.24	24
PEI Ultem 1010	DKD		64/36	50/50	Pitch	SOLVENT	24	190	0.26	100
PEI Ultem 1010	DKD		54/46	40/60	Pitch	SOLVENT	38	176	0.34	24
PEI Ultem 1010	DKD		43/57	30/70	Pitch	SOLVENT	29 .	158	0.24	100
PEI Ultem 1010	DKD	BN Platelets	43/49/8	30/60/10	Pitch	SOLVENT	12	174	0.24	100
PEI Ultem 1010	DKD	BN Platelets	64/18/18	50/25/25	Pitch	SOLVENT	12	160	0.18	100

		Type of	<u>1</u> c	Density	Average	Average	Aspect
		Fiber	(W/mC)	(gm/cc)	Diameter	Length	Ratio
Product Name	Supplier				(microns)	(microns)	
DKA	BPAmoco Corporation	Pitch	006	2.2	10	200	
DKD	BPAmoco Corporation	Pitch	009	2.2	10	200	
VMX-24	BPAmoco Corporation	Pitch	22	1.9	11	200	
AGM 94	Asbury Graphite Mills	PAN		1.81	7	150	
AGM 95	Asbury Graphite Mills	Pitch		1.91	11	200	
Fortafil 382	Fortafil Fibers Inc.	PAN		1.8	7	175	
Fortafil 482	Fortafil Fibers Inc.	PAN		1.8	7	175	
Grafil GM130E	Graphil Inc.	PAN	7	1.8	7	130	
Pyrofil TR50S	Graphil Inc.	PAN	7	1.82	7	8000	
Dialead K 6371M	Mitshubishi Chemical America	Pitch	140	2.1	7	20	
Dialead K 223HG LG	Mitshubishi Chemical America	Pitch	540	2.2		9009	
Dialead K 223HG	Mitshubishi Chemical America	Pitch	540	2.2	7	300	

Table 8

DOBUS COLUMN

### Duration (hrs) Test 0.03 10.5 0.31 9 24 24 of Friction Coefficient 0.48 0.42 0.54 0.5 <0.7 Wear Properties Temperature (F) Shaft 170 150 240 215 245 241 240 190 Wear (K) <10000 10,324 4400 225 969 657 935 167 % <u>⊕</u> ೫ <del>송</del> ន Graphite Flake Additive(s) BN Platelets BN Platelets **BN Platelets** Second **Comparative Compositions** 9 20 % **\$** ន 98 AGM 3243 Graphite Stainless Steel Fiber Aluminum flake Bronze Powder Bronze Powder Aluminum flake Additive Steel Fiber First 29 8888 % 8 09 for Comparative Polymeric Matrix Materials used Compositions Ultem 1040 Ultem 1040 Ultern 1010 Ultern 1010 **Ultern 1010 Ultern 1010** Polymeric Matrix PPS PPS 102 103 105 105 106 108 Test 101

# TABLE 9

Matrix	% Wgt.	Fiber	% Wgt.	Filler	% Wgt.	In- plane	Thru- plane	IN- plane
XYDAR 96403 LCP	40	DKD	60			2.85	5.13	
XYDAR 96403 LCP (Reprocessed)	40	DKD	60			2.94	6.83	
PPS	40			Aluminum Flake	60	8.58	8.13	
PPS	30			Aluminum Flake	70	14.98	15.12	
PPS	20			Aluminum Flake	80	20	21.7	
PPS	40	DKD	30	Aluminum Flake	30	4.5	5.36	
PPS	50	DKD	50	-		2.52	4.65	
PPS	40	DKD	60			2.92	7.36	
PPS	30	DKD	70			5.38	9.5	
PPS	50			Boron Nitride	50	0.8	1.1	
PEI	55	DKD	25	Teflon Flock	25	0.99	1.6	Ī
PEEK	50	DKD	25	Boron Nitride	25	1.15	2.86	
PPS	50			Aluminum Flake	50	1.76	2.	
PEEK	30	DKD	70			4.39	10.5	
PEEK	50			Boron Nitride	50	1.69	2.1	
PPS	50	. •		Aluminum Flake Boron Nitride	25/25			4.79
XYDAR 96403 LCP	40	DKD	60					1.97
PEI	50	DKA	50	,				1.44
PEI	50	DKD	25	Boron Nitride	25			1.56
FERRO 511TG 72001 PEN	40	BN PWD	60					3.82
PEI	70	DKA	30					0.82
PEI	60	DKA	40					1.03
PEI	40	DKA	60		·			2.51